THE JOURNAL OF CRANIOMANDIBULAR PRACTICE

CRANIO®

JULY 2000 VOLUME 18, NUMBER 3

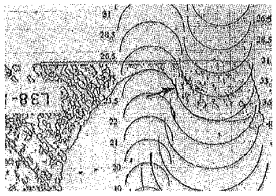
ISSN 0886-9634

Published Quarterly by:

CHROMA

CRANIO®

(CONTENTS continued from previous page)



The circle best fit method of Pullinger. (222)

The transverse angle of the fossa. (223)

CRANIO: The Journal of Craniomandibular Practice® (ISSN 0886-9634) is published quarterly by CHROMA, Inc., 5323 Brainerd Road, Suite 106, Chattanooga, TN 37411. Subscription rates: $90.00 ($110.00 foreign); institutions $130.00 ($150.00 foreign); in-training $65.00 ($80.00 foreign); single copy $28.00 ($31.00 foreign). (Prices subject to change.) POSTMASTER: Send address changes to *CRANIO: The Journal of Craniomandibular Practice*, P.O. Box 8887, Chattanooga, TN 37414. ©1998 by CHROMA, Inc. Periodicals postage paid in Chattanooga, Tennessee, and additional entry offices.

Change of Address: Publisher must be notified 60 days in advance of address change. Undeliverable journals will be destroyed.

Correspondence covering subscription matter should be addressed to *CRANIO: The Journal of Craniomandibular Practice*, P.O. Box 8887, Chattanooga, TN 37414, email address: *contact@cranio.com* (800) 624-4141 or (423) 899-1753, fax (423) 490-0791.

Bound Volumes available c/o CHROMA, Inc., P.O. Box 8887, Chattanooga, TN 37414. Bound Volume Number 17 will be available to all subscribers in early 2000. The volume will be hardbound in black buckram, with journal name, volume number, and year of issue stamped in gold on the spine. The cost for volume 17 is $90.00 ($98.00 foreign). Orders must be received by the publisher before March 1, 2000, to qualify.

Study groups, academies, and other professional organizations of 25 or more members may subscribe to *CRANIO* at the reduced rate of $70.00 for each U.S. member subscribing, or $80.00 for each member outside the United States. The president or secretary of the organization should send a list of all interested members with their complete addresses to CHROMA, Inc., P.O. Box 8887, Chattanooga, TN 37414. Remittance of U.S. dollars must be made in one check for the entire group. For groups of more than 100 members who wish to obtain a reduced rate, contact: Cynthia McLeod, CHROMA, Inc. (800) 624-4141.

BEHAVIORAL SCIENCE

Profile of TMD and Bruxer Compared to TMD and Nonbruxer Patients Regarding Chief Complaint, Previous Consultations, Modes of Therapy, and Chronicity

Omar Franklin Molina, D.D.S., M.S.; Jose dos Santos, Jr., D.D.S., M.S.; Stanley J. Nelson, D.D.S., M.S.; Thomas Nowlin, D.D.S., M.A.

0886-9634/1803-205$05.00/0, THE JOURNAL OF CRANIOMANDIBULAR PRACTICE,

Manuscript received February 23, 2000; revised manuscript received May 17, 2000; accepted May 23, 2000.

Address for reprint requests:
Dr. Omar F. Molina
7703 Floyd Curl Drive
San Antonio, Texas 78284-7890
email: santos@uthscsa.edu

ABSTRACT: This comparative study by groups assesses the profiles of TMD (temporomandibular dysfunction) and bruxism patients and TMD-nonbruxing patients regarding chief complaint, previous medical and dental consultations, duration of the chief complaint, previous medication, and use of splints. The sample consisted of a group of 340 TMD patients, 275 of whom were bruxers and 65 who were nonbruxers. Both patients and controls were consecutive referrals over a period of five years. The group of TMD and Bruxer was classified according to the degree of severity. One hundred eight (108), 84, and 83 patients demonstrated mild, moderate, and severe bruxism respectively. Information gathered included a set of questionnaires, history of signs and symptoms, and a clinical examination. The most common chief complaints in TMD bruxers and nonbruxers were facial, temporomandibular joint, headache and / or cervical pain, and joint noises. It was observed that the need for medical and dental consultations increased with the severity of bruxism. It was also apparent in this study that the need for medication (analgesics, muscle relaxants, and antidepressants), increased with the severity of bruxism. Moderate and severe subgroups of bruxers used significantly more splints compared to mild bruxers and to TMD-nonbruxer patients. Both groups of TMD + bruxism and TMD - nonbruxism sought medical and dental consultations with dentists (clinicians and specialists) neurologists, and otolaryngologists more frequently compared to other medical professionals. Since the need for health services increased with the severity of bruxism, this study urges the need to include a protocol or questionnaire to assess the severity of bruxing behavior in TMD patients in order to use a customized method of treatment/management. This study also reinforces the point of view that different subgroups of TMD and bruxism do exist and suggests a differentiated therapeutic approach. They show previously confirmed findings that pain is the major complaint of TMD and bruxer patients.

Dr. Omar Franklin Molina *received his D.D.S. degree in 1978 at the State University, Rio Grande do Sul and a Masters Degree in 1983 from the State University of Santa Catarina, Brazil. He specialized in orthodontics at the State University of Rio de Janeiro. Dr. Molina is a member of the American Equilibration Society since 1987 and is a member of the Center for Study of Craniomandibular Disorders at Porto Alegre. He has presented lectures on occlusion, facial pain, and parafunctional habits in Brazil and the United States and has published three books on TMD. He is an Adjunct Professor at the University of Texas Health Science Center at San Antonio, Texas.*

Bruxism is a poorly defined psychophysiological disorder usually thought of as one of many parafunctional behaviors that may occur at nighttime, daytime or both. Bruxism may be present along with other oral/jaw behaviors in the same individual and may be related to acute or chronic hyperactivity of the jaw elevator muscles. A number of oral jaw behaviors can be observed in children, adolescents, and adults, but bruxing behavior is perhaps the most universal form of the habits encountered in humans. Even though our understanding of bruxing behavior in terms of prevalence, pathological impact on the masticatory system, and prevalence in different population groups is quite clear at this time, little is known about the severity of bruxism in a large sample of TMD and bruxism patients.

There are two main modalities of bruxing: clenching and grinding. There are differences between the two concerning neurological behavior. Teeth clenching, described also as static or centric bruxism, is represented by isometric unconscious contractions of the masticatory muscles, which may be activated at the level of the CNS, and commonly presents diurnal manifestation. Grinding of the teeth, also known as dynamic or eccentric bruxism, results mostly from inputs originating in the brain stem (upon the limbic system) due to physical or emotional stresses and produces isotonic activation of masticatory muscles during sleep.

Signs and Symptoms

The presence of signs and symptoms resulting from this behavior varies greatly in different individuals; therefore, they are expected to present different profiles regarding frequency and severity, capability for adaptation and probably one or a combination of different etiological factors. Chronic bruxing behavior combined with persistent facial pain is a clinical situation that both patient and clinician confront. This is particularly true when the disorder is chronic and other complex psychophysiological disorders including stress, anxiety, frustration, and/or depression predominate.

Pain is an important characteristic of TMD because it is the most important reason for patients to seek treatment. It is intriguing that the effects of bruxism may be negligible in some individuals, whereas in others, signs and symptoms are of such nature that they need urgent diagnosis and care. The answer to this dichotomy may be found in those clinical manifestations of signs and symptoms which emerge when studying larger samples of TMD and bruxing behavior patients. Signs and symptoms of bruxing behavior can be found in some or all components of the masticatory system, but the most common symptom of daytime or nighttime bruxism is tenderness to palpation particularly in jaw elevator muscles and probably in the lower lateral pterygoid muscle. Tooth wear may not be present in all cases and when observed does not necessarily mean actual bruxing behavior.

Literature Review

Bruxism is a genuine oral/jaw behavior, and because it leads to or is part of a broader symptomatology with different labels,[1] its diagnosis, treatment, and/or management is a challenge. Based on emerging and convincing evidence that bruxism may also be a motor or neurological disorder,[2] the etiology of bruxism is now more complex and has hampered efforts to establish proper modes of therapy and/or management. It is unfortunate that this behavior has been conceptualized purely as a dental problem in the dental literature[3] and as a behavior devoid of any relationship to the stomatognathic system in the psychology literature.[4] Convincing evidence is now emerging which suggests that bruxers do not constitute a homogeneous group, but rather several subgroups where similar and different characteristics can be observed.[5-8]

Bruxers often complain of headaches, pain in the neck, back, shoulder or chest, stiffness and pain in the morning, and tenderness in the temporomandibular joints.[9] Systematic attempts to diagnose and classify bruxing behavior have been made using a number of approaches ranging from wear facets[10] to self reports and questionnaires,[11] nocturnal EMG activity,[12] and polysomnographic (PSG) studies.[13] More recently, Molina, dos Santos, Nelson and Nowlin[14] designed a questionnaire and used clinical examination to assess a large sample of TMD and bruxing behavior patients. This approach enabled them to observe three different groups of bruxers based on the severity of the behavior. There is now substantial evidence suggesting that bruxism may be an important component in exacerbating and/or sustaining headache, joint, and muscle pain.[14]

There is growing evidence that different groups of TMD and bruxing behavior patients do exist. By classifying bruxer patients into three different groups (sleep, depressed, and destructive), Ware and Rugh[13] implied that bruxers could be different with regard to their clinical manifestations and etiology, the severity of bruxing behavior, and the sleep stage in which the behavior predominantly occurred.

Another problem is the scarcity of information regarding the need for health services, previous medical and dental consultations, drug consumption, chronicity, chief complaint, and use of interocclusal devices. Even though excellent studies in this area have been performed, they have only included TMD patients and have highlighted the presence of different subgroups.[15,16] These studies do not take into consideration the presence, severity, and/or impact of moderate and severe bruxing behavior on the stomatognathic system which provide a deeper insight into the health profile of bruxers.

There are several studies relative to splints,[17,18] signs and symptoms of TMD,[13] the use of drugs, and quality of life[19,20] in TMD and bruxing behavior patients. However, information regarding chief complaints, use of drugs, chronicity, previous medical and dental consultations, and the use of splints in TMD and bruxing behavior patients when classified by the degree of severity is still poor.

Contributing Factors

Bruxism occurs frequently in the general population. All people grind and/or clench their teeth with different frequencies and intensities at different times during their lives, and the prevalence of bruxism in groups of TMD patients is also high. High frequency of specific joint and muscle disorders such as bruxing behavior becomes more severe, suggesting that severity is an important component to the increase in the amount of nociceptive input to the trigeminal system. Headache pain initiating early in the morning suggests the presence of this parafunctional habit in most cases.

Many clinicians complain that "some bruxing patients," despite the use of a well fabricated interocclusal device, continue to brux. Other clinicians become disappointed and sometimes frustrated with clinical results even when splints, analgesics, and anti-inflammatory drugs have been used to reduce clinical symptoms. It is likely that answers to these frustrating questions can be found in the severity of bruxism, the interaction of various unknown etiological factors, psychosocial characteristics of patients, and possibly different individual responses to loads impinging upon muscles and joints. Because different forces may impact differently in different individuals, we can speculate that a threshold for pain and dysfunction does exists in bruxers. Pain may also be the result of various interacting factors operating in the same individual.

The fact that different prevalences of mild, moderate, and extreme pain levels in TMD patients can be observed and that different subgroups of TMD and bruxism patients do exist suggests that there may be different factors including severity of bruxing behavior, psychosocial profile, threshold to withstand pain, and most likely, coping strategies responsible for the differences. If the severity of bruxing behavior is an important factor causing, sustaining and/or perpetuating TMD symptoms, it may be expected that TMD and subgroups of bruxing behavior patients are different with regard to the number of previous medical and dental consultations, previous modes of therapy, history of splint usage, drug consumption, chief complaint, and chronicity. These differences may comprise indirect indicators proving the heterogeneity of such groups. Because bruxism is now thought of as a more or less destructive oral/jaw behavior which can cause a diversity of symptoms in the joints, teeth, muscles, alveolar bone, and other structures, it is expected that moderate and severe subgroups of bruxing behavior patients seek more pain services, make greater use of analgesics, anti-inflammatory drugs, muscle relaxants, and splints to protect the teeth and joints, compared to mild bruxers and TMD nonbruxing behavior patients.

Hypothesis

The present study was undertaken to:

1. Assess the profile of three different groups of bruxers and TMD patients regarding chief complaint, dental and medical consultations, previous modes of therapy including analgesics, muscle relaxants and splints, and chronicity of the chief complaint .
2. Test the hypothesis that bruxism is a significant factor in the etiology of TMD, and that if moderate and heavy bruxers are more impaired by their pain and other functional disorders, then it may follow that these subgroups are characterized by an increased number of previous medical and dental consultations, and by increased use of drugs and interocclusal devices to reduce their pain and other functional disorders when compared to mild bruxers and TMD-nonbruxing behavior patients. We hope that by depicting this profile of bruxers based on the degree of severity, some clues about treatment needs, behavioral trends, and difficulties with treatment/management of moderate and severe subgroups may emerge.

Materials and Methods

Information as to the frequency of signs and symptoms of TMD and bruxing behavior was gathered from a population of TMD patients referred to a center for the study of TMD and facial pain for diagnosis and treatment. This population consisted of a sample of 340 TMD patients referred over a period of five years. There were 298 females and 42 males, and the mean age of the group was 34.44 years (range 6-73). The following protocol was used initially to diagnose and classify patients as presenting TMD and mild, moderate, and severe bruxing behavior:

1. A set of questionnaires;
2. History of signs and symptoms;
3. Clinical examination including palpation of muscles and joints, evaluation of jaw movements, analysis of the occlusion, search for trigger points and patterns of referred pains, and application of diagnostic tests to assess the presence of myofascial pain disorder syndrome (MPDS) and/or specific joint disorders. Dental casts, panoramic, transcranial, tomographic x-rays and/or MRI, when necessary, were used to complement the diagnosis.

Once patients were diagnosed as presenting with TMD, part of the comprehensive questionnaire was used to diagnose patients as presenting with or without bruxing behavior (daytime or nighttime bruxism). One questionnaire was used to assess the severity of bruxing

CENTER FOR THE STUDY OF CMD AND OROFACIAL PAIN
Rua Felipe Nery, 312-201 90440-150 Porto Alegre, RS
Brazil

Patient Name: _____ Age: ____ Sex:____ Phone:_____
Referred by:_____ Date: _____

******

PART I

A. Chief complaint:

B. Signs and symptoms of CMD:

1. Masticatory muscle pain: Unilateral R - L Bilateral

2. Muscle tenderness:
- Protective splinting pain:

- Anterior temporal	Right	-	Left	Bilateral
- Middle temporal	Right	-	Left	Bilateral
- Posterior temporal	Right	-	Left	Bilateral
- Superf. masseter	Right	-	Left	Bilateral
- Deep masseter	Right	-	Left	Bilateral
- Lower lat. pterygoid	Right	-	Left	Bilateral
- Ant. belly digastric	Right	-	Left	Bilateral
- Post. belly digastric	Right	-	Left	Bilateral
- Sternocleidomastoid	Right	-	Left	Bilateral
- Splenius capitis	Right	-	Left	Bilateral
- Trapezius	Right	-	Left	Bilateral

3. History of trismus:

4. Temporomandibular joint:
- Degree of jaw opening: mm
- Limitation of movement Mild - Moderate - Severe
- Jaw deviation during opening:
- Joint noises:

- Clicking	Right	-	Left	Bilateral
- Popping	Right	-	Left	Bilateral
- Reciprocal click	Right	-	Left	Bilateral
- Crepitus	Right	-	Left	Bilateral
- Anterior portion of the joint capsule	Right	-	Left	Bilateral
- Posterior portion of the joint capsule	Right	-	Left	Bilateral

5. History of luxation

6. Internal derangements:
- Evidence of retrodiskal pain:
  - Pain occuring during CR manipulation
  - Mild pain palpating TMJ via auditory meatus
  - Pain increases or is triggered by clenching in maximum intercuspation
  - Pain decreases when biting on a separator (cotton roll) placed between posterior teeth
  - Ipsilateral jaw movements trigger or exacerbate pain (on the affected side)
  - Central excitatory effects may be observed

- Evidence of capsular pain:
  - Pain on lateral palpation upon the condyle
  - Sustained border jaw opening causes pain
  - Pain decreases during clenching in maximus intercuspation
  - Restriction of jaw movements
  - Central excitatory effects may be observed

- Evidence of disk attachment pain:
  - Intermittent pain (occurring several times during the day)
  - Pain on opening occuring concomitantly with joint noises
  - Condition resistant to treatment
  - Talking, biting, smiling, opening the mouth cause pain
  - Restriction of jaw opening
  - Capsulitis and retrodiskal pain may occur concomitantly

- Evidence of disk displacement pain:
  - Reciprocal clicking
  - Normal jaw opening
  - Little or no clicking occurring opening on a protrusive position

- Evidence of anterior disk displacement without reduction:
  - Severe pain
  - Louder joint noises
  - Impaired jaw opening (less than 27 mm)
  - Opening on a protrusive position increases degree of opening
  - Ipsilateral jaw movements occur normally
  - Contralateral jaw movements impaired
  - Patient is able to correlate signs and symptoms with any specific cause (for example, accident)

7. Aural symptoms

- Ear pain	Right	-	Left	Bilateral
- Post auricular pain	Right	-	Left	Bilateral
- Tinnitus	Right	-	Left	Bilateral
- Hearing loss	Right	-	Left	Bilateral
- Sense of stuffiness in the ear	Right	-	Left	Bilateral

- Equilibrium impairment during walking (how often):_____

8. Cervical symptoms:
- Neck pain (location and chronicity)
- Back pain (location and chronicity)

PART II

C. Quality of pain:

- Where does the pain begin?	Pattern of radiation:	
- Mode of onset:	Slow	Fast
- Manner of flow:	Steady	Paroxysmal
- Quality:	Bright	Dull
	Pulsating	Itching
	Burning	Pricking
	Stinging	Aching

- Frequency (number of times by week or month):
- Chronicity (days, weeks, months, or years):
- Duration (seconds, minutes, hours, days):
- Severity: Mild Moderate Severe
- Temporal behavior Continuous Intermittent Recurrent
- Effects of functional activities:
- Concomitant changes:

Nausea	Vomiting	Lacrimation	Photophobia
Redness	Spasm	Hearing difficulties	
Muscle weakness		Nasal symptoms	Sweating
Piloerection	Color changes	Temperature change	

- Chronological history of pain and effects prior to treatment:
- How patient describes pain:

Tension	Pressure	Electric shock-like
Pulsating	Band-like	Compressing
Aching	Dull	

- Factors that possibly trigger pain:

Jaw manipulation	Chewing	Touch	Wind
Cold	Dental treatment		Talking
Smiling	Opening the mouth		
Professional activities	Others		None

- Putative etiology:

Psychologic tension	Acute or sustained stress
Motor car accidents	Entubation (surgery)
Clenching	Grinding
Extraction of 3rd molars	Other factors

- List factors that decrease pain:
- List factors that exacerbate pain:
- List of drugs being taken:
- Previous consultation with other professionals:
- List modes of therapy used before including analgesics and tranquilizers:

Figure 1
Evaluation and questionnaire used to define the patient's symptoms: Parts I and II. (*continued on next page*)

PART II (*continued from previous page*)

D. Types of headaches:
- Severity of pain according to VAS
  - Presence of headache:
- Evidence of tension or muscle contraction headache:
  - Pain on both sides of the head
  - Pain easily located by patient
  - Pain, frontal-temporal, occipital-suboccipital in location
  - Trigger points detected in cervical and neck areas
  - Nausea present
  - Pain described by patient as band-like or as compressing helmet

- Evidence of vascular pain (migraine)
  - Pain mild or severe
  - Pain steady (may last for weeks)
  - Ipsilateral pain in the neck or TMJ
  - Pain pulsating in quality
  - Central excitatory effects (including nausea, vomiting, visual disturbances and photophobia)
  - Facial pain occurring from central excitatory effects
  - Unilateral pain
  - Patient reports medications such as neusaldine, hormigraine or cafergot are inefficient

- Evidence of neurogenic pain
  - Pain episodes last seconds
  - Precise location of pain
  - Trigger points
  - Pain described as electric shock-like
  - Lips, cheeks, alveolar region and throat are areas most commonly affected
  - Pain occurring in people 50 years old or older
  - No central excitatory effects

PART III

E. Signs and symptoms of bruxing activity:
- Feeling of fatigue on the masseter muscle Right - Left Bilateral
  Diurnal Nocturnal On awakening
- Feeling of stiffness on the masseter muscle Right - Left Bilateral
  Diurnal Nocturnal On awakening
- Wear facets: Location:
  Mild Moderate Severe
- Patient aware of diurnal clenching:
  Occasionally Frequently

- Headache, masseter muscle and/or TMJ pain on awakening
- Feeling of clenching or grinding teeth durng sleep
- Toothache or sensation of discomfort to teeth on awakening
- Noises of nocturnal grinding reported by spouse or friend
- Stressors of everyday life
  - List of stressors that occurred within the last 12 months before the onset of pain:

PART IV

F. Occlusion
- Dental pain: Location
- Classification (angle):
- Bite type (normal, overjet, overbite, deep, open, crossed)
- Prosthesis present (type and status)
- Wear facets and location
- Occlusal truamas: Location Cause
- Slide in centric components: Horizontal Vertical Lateral
- Working side
  Canine guidance Right - Left
  Group function Right - Left
- Balancing side:
  Interferences Right - Left
- Anterior guidance
  Protrusion Right - Left
- Posterior protrusive interferences
- Location of occlusal interferences
- Chewing:
- Difficulties chewing:
  Causes Muscle pain Fatigue
- Difficulties opening mouth:
- Tongue biting:
  Occasionally Frequently Very frequently
- Cheek biting:
  Occasionally Freequently Very frequently

G. Diagnosis
- Cervical pain
- Tension headache
- Common migraine Right - Left Bilateral
- Classic migraine Right - Left Bilateral
- Combination headache Right - Left Bilateral
- Myofascial pain Right - Left Bilateral
- Dental pain Right - Left Bilateral
- Bruxism: Right - Left Bilateral
  Clenching Grinding
- Parafunctional oral activity
- Retrodiskal pain
- Capsular pain
- Disk attachment pain
- Anterior disk displacement with reduction
- Anterior disk displacement without reduction
- Protective muscle splinting
- Masticatory pain
- Others: Specify

H. Treatment plan:
- Symptomatic
  - Voluntary separation of teeth
  - Counseling
  - Psychotherapy
  - Masticatory muscle exercises
  - Occlusal bite splint
  - Analgesic
  - Anti-inflammatory drugs
  - Minor tranquilizers
  - TENS
  - EMG biofeedback
  - Local anesthesia for trigger points
  - Cold application
  - Moist heat application

Irreversible:
- Occlusal adjustment through selective grinding
- Restorative dentistry (operative)
- Orthodontics
- Prosthodontics
- Orthognathic surgery

Figure 1 (continued)
Evaluation and questionnaire used to define the patient's symptoms: Parts III, IV, and V.

behavior (**Figure 1**). All TMD patients, bruxers (275) and nonbruxers (65), fit the criteria and were seeking active treatment for their symptoms. Some patients had been taking self-prescribed drugs, including analgesics and myorelaxants to reduce muscle, joint, and/or headache pain before their first visit for examination and diagnosis. They completed another questionnaire to gather information about bruxing behavior, first to determine if patients were TMD and bruxers, and then, based on the number of bruxism-related signs and symptoms, they were allocated to a mild, moderate, or severe group.

Specific criteria to allocate TMD and bruxer patients to specific groups of bruxing behavior included the following:

1. Presence of wear facets on the teeth;
2. Recent history (last six months) of noises associated with nocturnal teeth grinding as reported by a friend, relative, and/or spouse;
3. Anamnestic report of catching himself/herself clenching the teeth during the day;
4. Anamnestic information of feeling tension and stiffness during the day;
5. Anamnestic account of feeling tension and stiffness upon awakening;
6. Anamnestic description of awakening frequently at night grinding or clenching;
7. Hypertrophy of the masseter and/or temporalis muscles;
8. Feeling fatigue to the masseter muscles on awakening;
9. Complaints of fatigue of the masseter muscles during the day;
10. Report of awakening at night or in the morning with the jaws locked;
11. Cervical pain on awakening;
12. Awakening in the morning with pain in the masseter and/or temporalis muscles;
13. Feeling of body fatigue and/or of having slept poorly when awakening in the morning;
14. Toothache or feeling of discomfort of the teeth on awakening;
15. Recent history of chronic dislocation of permanent or temporary restorations.

Patients scoring 3-5 points of the above list of 15 items were considered mild, those scoring 6-10 points were classified as moderate, and those scoring 11 points or higher were considered severe bruxers. This scale of severity was designed and developed keeping in mind that it would be validated or at least be clinically acceptable if epidemiological findings in 275 bruxers demonstrated a significantly higher prevalence of specific muscle and joint disorders. Once patients were diagnosed as presenting with TMD and bruxism, a second questionnaire was used to gather information about the chief complaint, chronicity, previous modes of therapy including use of analgesics, anti-inflammatory and myorelaxant drugs, and splints, and a number of previous consultations with health related professionals. Our main goal was to assess a possible relationship between the severity of bruxing behavior and previous consultations and modes of therapy and/or management.

Results

The results of this study are shown in **Table 1** through **Table 6**. Statistics were performed using the following: Chi-Square, likelihood ratio Chi-Square, Mantel-Haenszel Chi-Square, Fisher's Exact (2 tail), Phi Coefficient, and Contingency Coefficient tests.

Table 1 demonstrates that of the total group of 340 TMD patients, males and females did not present statistically significant differences ($p > 0.8$) between TMD+bruxer (mild, moderate, and severe) patients as compared to TMD-nonbruxers patients.

Table 2 shows that the prevalence of chief complaints in the groups of mild, moderate, and severe TMD+bruxers and in the TMD-nonbruxing group did not present statistically significant differences between facial pain ($p > 0.8$), temporomandibular joint pain ($p > 0.065$), headaches and cervical pains ($p > 0.2$), difficulty opening the mouth, protective splinting ($p > 0.9$), ear symptoms ($p > 0.9$), neuropathic or neurogenous pains ($p > 0.3$) and toothache, malocclusion, and gingival recession ($p > 0.2$). However, when joint noises were detected, the mild group of TMD+bruxing behavior presented a statistically significant prevalence of symptoms when compared to the other groups ($p < 0.04$). In the same fashion, the moderate group of TMD+bruxers displayed statistically significant difference ($p < 0.001$) of bruxism symptoms, pressing the teeth, and occlusal injuries when compared to other groups.

Table 3 demonstrates that the mean chronicity of the chief complaint was about 48.48 months, 49.01 months, 65.65 months, and 58.49 months in the mild, moderate, and severe groups of bruxers and in the TMD-nonbruxing group respectively.

The statistical analysis of **Table 4** shows that related to previous medical and dental consultations, the severe TMD+bruxers group showed a statistically significant higher number of visits ($p < 0.001$), followed by the moderate TMD+bruxers group (with the exception of neurologist consultation where the mild TMD+bruxers group followed the severe group), when compared to the other groups.

Table 1
Demographic Data of TMD and Bruxing Behavior Patients and TMD Nonbruxing Behavior Controls

	TMD and bruxers N = 275						TMD nonbruxers N = 65	
	Mild* N = 108		Moderate** N = 84		Severe*** N = 83			
Patients	n	%	n	%	n	%	n	%
Females	97	89.81	72	85.71	72	86.75	57	87.69
Males	11	10.19	12	14.29	11	13.25	8	12.31
Totals	108	100.00	84	100.00	83	100.00	65	100.00
Mean age	32.23 yrs.		32.93 yrs		32.35 yrs.		37.28 yrs.	
Range	14-60		6-57		13-73		17-60	
SD	10.33		12.16		12.32		9.15	

* Mild = Score of 3-5 points in the list of 15 items for bruxing behavior criteria.
** Moderate = Score of 6-10 points in the same list of 15 items.
*** Severe = Score of 11 or higher points in the same list of 15 items.

The statistical analysis of **Table 5** demonstrates that the previous modes of therapy used by the severe TMD+bruxers group was significantly higher ($p < 0.001$) than the other groups. The only exception was the consultation with psychiatrists/psychologists and use of natural medicines presented by the moderate TMD+bruxers which was higher than the other groups ($p < 0.02$).

Table 6 describes the number and corresponding means of medications and bite splints used by the groups.

Table 2
Frequency of Chief Complaint in the Groups of Bruxers and in the TMD-Nonbruxing Control Group

	TMD + bruxers N = 275						TMD nonbruxers N = 65	
	Mild* N = 108		Moderate** N = 84		Severe*** N = 83			
Chief complaint	n	%	n	%	n	%	n	%
Facial pain	33	30.56	30	35.71	28	33.73	19	29.23
TMJ pain	18	16.67	12	14.29	21	25.30	19	29.23
Joint noises	18	16.67	3	3.57	6	7.23	5	7.69
Headache/cervical pain	17	15.74	10	11.90	9	10.84	14	21.54
Diffic. open/protect. splint	7	6.48	7	8.33	7	8.43	4	6.15
Bruxism/ pressure of teeth/occlusal injuries	7	6.48	17	20.24	3	3.61	0	0
Eye symtoms	4	3.70	3	3.57	2	2.41	2	3.08
Neuropathic/ neurogenous pains	1	0.93	0	0	2	2.41	2	3.08
Toothache/malocc. gingival recession	3	2.78	2	2.38	5	6.02	0	0
Totals	108	100.00	84	100.00	83	100.00	65	100.00

Table 3
Mean Chronicity of the Chief Complaint by Groups in Months

	TMD + Bruxers N = 275			TMD-nonbruxers
	Mild N = 108	Moderate N = 84	Severe N = 83	N = 65
Months	48.48	49.01	65.65	58.49
Range	1 - 360	1 - 240	1 - 610	1 - 360
SD	43.37	50.14	90.10	55.58

Discussion

Table 2 demonstrates that 69 (63.88%) mild bruxers presented for initial consultation with a chief complaint of facial, TMJ, neurogenous, cervical and/or headache pain, 52 (61.90%) moderate bruxers, and 60 (72.28%) severe bruxers presented a complaint of pain compared to 54 (83.07%) TMD-nonbruxers. Overall, 181 (65.81%) bruxers presented a chief pain complaint. Our results are in accordance with those of Ren and Isberg[21] who found a prevalence of a chief complaint of about 61.34% of TMJ/ear pain in the temporal region, headache, pain in the masticatory muscles during chewing, and pain in the neck in a group of 53 TMD patients presenting unilateral tinnitus and TMD. Even though this prevalence was similar to that in our study, not all patients in the Ren and Isberg study[21] were bruxers. Murray, et al.[19] assessed a group of 121 TMD patients and found a prevalence of 58.25% of facial, TMJ and/or headache pain. Patients in their study were all TMD, but their prevalence was not about a chief complaint and not all of their patients were bruxers. Supporting our findings, Greene, et al.[22] assessed the heterogeneity of a TMD population and concluded that pain is an important feature of TMD, because it is the most common reason for patients to seek treatment. Yet another study[23] found a prevalence of about 44.5% of pain in the face, jaws, and/or headache in a group of 227 TMD patients, and only 37% of these patients were bruxers.

Fricton, Hathaway and Bromaghin[20] assessed a group of chronic pain patients presenting with psychiatric problems and unsuccessful treatment elsewhere. Their chief complaints included some combination of headache, jaw pain, neck, and shoulder pain. Their primary diagnosis was myofascial pain in 59.8% of the cases. This prevalence was little different from the 69.11% of pain in

Table 4
Number of Previous Consultations by Groups

	TMD + bruxers N = 275						TMD nonbruxers N = 65	
	Mild* N = 108		Moderate** N = 84		Severe*** N = 83			
Consultations	n	%	n	%	n	%	n	%
Dentists (clinicians)	18	40.91	62	61.39	77	41.18	11	47.83
Dentists (specialists)	14	31.82	13	12.87	25	13.37	0	0
Neurologists	6	13.64	9	8.91	15	8.02	5	21.74
E.N.T.	4	9.09	6	5.94	21	11.23	5	21.74
Physicians (general)	0	0	5	4.95	26	13.90	2	8.69
Psychiatrists/ psychologists	2	4.54	6	5.94	23	12.30	0	0
Totals	44	100.00	101	100.00	187	100.00	23	100.00
Means of previous med. consultations	0.40		1.20		2.25		0.35	

Table 5
Number of Previous Modes of Therapy by Groups

	TMD + bruxers N = 275						TMD nonbruxers N = 65	
	Mild* N = 108		Moderate** N = 84		Severe*** N = 83			
Previous modes	n	%	n	%	n	%	n	%
Analgesics and anti-inflammatories	48	54.55	42	42.00	65	34.76	29	87.88
Muscle relaxants	11	12.50	8	8.00	17	9.09	1	3.03
Uses of antidepressants	3	3.41	7	7.00	18	9.63	0	0
Bite splints	11	12.50	22	22.00	51	27.27	1	3.03
Occl. adjustment/ prosthodontics/ortho/ endo, etc.	6	6.82	5	5.00	27	14.44	0	0
Psychiatrists/ psychologists/ natural medicines	9	10.23	16	16.00	9	4.81	2	6.06
Totals	88	100.00	100	100.00	187	100.00	33	100.00

Total number of times that different therapies were used by the 275 TMD and bruxing behavior patients: 375
Mean: 375/275 = 1.36

the group in this study of 340 TMD patients (bruxers and nonbruxers). A comparative study[24] of subjects and 60 TMD patients found that the greater the level of nocturnal EMG activity of bruxism, the more likely he/she was to present signs and symptoms of jaw dysfunction. It was also clear that tooth wear could be correlated with both increased nocturnal EMG activity and signs and symptoms of jaw dysfunction. Repeated episodes of joint inflammation and/or injury resulted in a cyclical clinical course, progressive soft tissue insult, and eventually, the formation of adhesions which further compromise joint function and range of motion.[25]

Prolonged injurious biomechanical loading of the joint combined with increased jaw muscle activity may be

Table 6
Total Number of Analgesics/Anti-inflammatories, Muscle Relaxants, Antidepressants, and Splints Used by Groups

	TMD + bruxers N = 275						TMD nonbruxers N = 65	
	Mild* N = 108		Moderate** N = 84		Severe*** N = 83			
Modes of therapy	n	Mean	n	Mean	n	Mean	n	Mean
Analgesics and anti-inflammatories	76	0.7	169	2.01	181	2.18	28	0.43
Relaxation drugs	11	0.10	8	0.09	17	0.20	1	0.01
Antidepressants	3	0.02	7	0.08	18	0.21	0	0
Bite splints	11	0.10	22	0.26	51	0.61	1	0.01
Totals	101	93.00	206	2.44	267	3.20	30	0.45

Total number of times that different therapies were used by the 275 TMD and bruxing behavior patients: 375
Mean: 375/275 = 1.36

significant factors initiating pathological changes in this structure. The findings in the current study were confirmed by Morawa, Loos and Easton[26] who observed that: "the most common complaint of a patient being evaluated for TMJ dysfunction will be unilateral pain in the area of the TMJ, the temporal region, the area of the ramus, or the lateral cervical region." A study[9] detected that bruxers do present many signs and symptoms of TMD including headache, aching neck, throat, or shoulders and that frequent clenchers significantly more often report pain in the face, neck, and back. A study related to destructive bruxism[13] demonstrated that nocturnal bruxers, complaining of severe myofascial pain and TMD, brux primarily during REM sleep, while those with less severe complaints tend to brux primarily in non-REM sleep stages. Thus, it is apparent that pain in severe nocturnal bruxers can also be correlated to sleep stages. It is very likely that nocturnal bruxism which occurs primarily during REM sleep can be correlated with the clinical difficulties to reduce pain and some other functional disorders observed in many severe bruxers, even when they wear a splint. Pain is also the chief complaint for the majority of patients presenting at an emergency dental service and is associated with health care utilization for TMD in epidemiological studies.[27,28] Additional support for our findings came from another study[29] which found that the most frequent chief complaint in TMD patients was pain either isolated or in combination with other TMD signs and symptoms. Our results were similar to the frequency of 52.32% of "head and neck related pain" observed by Yustin, et al.[30] in their study of 86 TMD and bruxing patients.

Table 3 demonstrates that the mean chronicity of the chief complaint in the mild, moderate, and severe bruxer groups and in the TMD-nonbruxing patients was 48.48, 49.01, 65.65 and 58.49 months, respectively. The mean chronicity of the chief complaint in the TMD+bruxing behavior group (275 patients) was about 54.38 months compared to 58.49 months in the TMD-nonbruxing behavior group. When matched to mild and moderate bruxers, severe bruxers presented a higher chronicity of chief complaint (65.65 months). Fricton, Hathaway, and Bromaghin[20] assessed a group of chronic pain patients and found a mean duration of pain complaint of about 64.8 months at the time of examination. This difference is related to the exclusion of acute cases in their sample. Butterworth and Deardorff[31] found that a group of TMD patients presented a mean chronicity of about 33.18 months of pain duration, but not all patients in their group were bruxers and this chronicity was only for pain. Another study[32] observed that the mean duration of the "problem" in a group of TMD/MPDS patients was about 102 months as compared to 54.38 months observed in this study's group of TMD+bruxing behavior patients.

Okeson, Kemper, and Moody[17] studied the role of occlusal devices in the treatment of acute and chronic pain and other temporomandibular disorders and found that chronic TMD patients presented a mean chronicity of about 44.4 months compared to 54.38 months in the current study. The chronicity observed in their study was based only on pain. All of the patients in the current study were TMD and bruxers compared to "CMD patients" in their study. Intriguing are the reasons why most patients in our group of 340 patients became chronic and therefore needed specialized therapy/management. At biochemical and neurophysiological levels, other elements including increased central and peripheral sensitization, a larger receptive field, increased memory for pain, poor descending inhibitory system (PDIS), negative learning, and other factors may also be responsible for the perpetuation of pain and poor therapeutic response. Supporting this assumption, one study[33] suggests that chronic pain depletes the level of brain serotonin, particularly in the area of the dorsal raphe nucleus. This depletion is thought to account for the apparent ineffectiveness of opiates as analgesia in chronic pain.[34]

Table 4 demonstrates that the whole group of 275 TMD+bruxers consulted about 332 clinicians and specialists in different health related areas (mean 1.21) compared to 23 (mean 0.35) in the TMD-nonbruxing behavior group. Dentists (clinicians and specialists), ear, nose, and throat specialists, and neurologists were consulted more frequently as compared to other health related professionals. One study[35] assessed a group of 25 chronic patients with signs and symptoms of MPDS. It was found that besides family practitioners (40), ear, nose, and throat specialists (32) and neurologists (68) were the most frequent specialists consulted for the diagnosis and treatment of their affliction. Results of that study were similar to those in this study. The frequency of medical/dental consultations increased with the severity of bruxism: 44 (mean 0.40) in the mild group, 101 (mean 1.20) in the moderate group, and 187 (mean 2.25) in the severe group. The mean of 1.28 of previous medical and dental consultations in the group of 275 TMD and bruxers was very different from the mean of 4.9 previous consultations observed in another study,[20] but only patients with chronic disorders and psychiatric problems were included in that study. Another study[35] found an average number of previous consultations of about 4.72 but, again, MPDS patients in this group were more chronic and were considered "treatment failures." The average number of previous medical and dental consultations observed in a group of 94 chronic TMD-MPDS patients in the Fricton and Olsen

study[32] was about 3.5, which is closer to the mean of 2.25 previous consultations found in the current study's group of severe bruxers. This difference may be explained by the inclusion of acute pain patients in the study (less than six months). It is significant to mention a study by Butterworth and Deardorff[31] in which they classified TMD patients according to the degree of psychopathology derived from using psychometric tests. Those patients presenting higher scores in somatization, obsessive-compulsive behavior, depression, anxiety, phobias, and psychosis demonstrated a mean number of previous consultations of about 2.76. Pain is considered an important stressor and may influence psychosocial factors such as anxiety, depression, and poor coping strategies. Severe bruxers had more visits to physicians and dentists and used drugs more often to alleviate pain and anxiety.

In partial support for our findings one study[35] assessed 25 chronic MPDS patients, where investigators observed that most of the patients had previously received several modes of therapy. These therapies included a management program i.e., physical therapy, relaxation training, spray and stretch, TP injections, but each one was conducted as individual treatments and not integrated into a comprehensive and progressive treatment plan. Severe bruxers may present increased nociceptive input to the trigeminal system and then more persistent and severe pain which is less likely to respond favorably to isolated modes of therapy. Von Korff, et al.[28] assessed a group of 242 chronic TMD patients (not all bruxers) and found that a small percentage of individuals with severe, persistent pain, which had persisted for seven or more days of pain-related activity limitation, tended to demonstrate increased utilization of health care. Because bruxers are thought of as presenting more traits of the Type A personality,[36] it is likely that they are strongly motivated by stress/tension derived from their personality traits and also from chronic pain. Because severe bruxers may also present some specific personality traits, they may be encouraged to face and/or live in situations or circumstances that cause chronic stress and tension.

Table 5 demonstrates that 54.55% (48 patients) in the mild group, 42.0% (42 patients) in the moderate group, and 34.76% (65 patients) in the severe group in a total of 155 (56.36%) TMD and bruxing behavior patients had used analgesics and anti-inflammatory drugs before initial consultation compared to 29 patients (87.88%) in the TMD-nonbruxing group. Severe bruxers used muscle relaxants (9.09%) compared to mild (12.50%), and moderate bruxers (8.0%). Sixty-nine and forty-five hundredths percent (69.45%) (191 patients) in the current study's group of bruxers+TMD had used analgesics and/or muscle relaxants. This finding was very similar to the 64.2% drug users in the study of Reik and Hale.[37] Only 73% of the patients in the Reik and Hale study were bruxers. In the Ware and Rugh study,[13] 60.0% of the patients were using medication to relieve pain in the group of "destructive bruxers." This difference in medication use is not significant. Increased use of medication is a characteristic of chronic facial pain patients, and near the end of the sequence, many of them may have multiple drug dependencies and addictions, high stress levels, loss of vocation, permanent disability, or may be involved in legal litigation in addition to their pain problems.[33] One study[36] assessed the personality traits of a group of subjects with long-standing bruxism, and the investigators observed that compared to normal individuals, the chronic bruxers described themselves as more anxiety prone, demonstrated statistically higher values at the somatic anxiety scale (which is assumed to measure autonomic disturbances and diffuse stress), and were predisposed to panic attacks. Bruxers also demonstrated increased subjective muscular tension and aches, and difficulties relaxing. Noteworthy to mention is that 69% of a group of 29 bruxers in one study reported that stress was the cause of their bruxing behavior.[36] In clear contrast with this study, another study[39] demonstrated that increased bruxing behavior could be related to poor awareness of the stressors of everyday life.

In the study of Lobbezoo, et al.,[15] 48% of TMD patients used analgesics and other medications, but only 51% of the sample presented with grinding and clenching. In the Dao, et al. study,[5] pain was not a complaint of sleep bruxers, although their data demonstrated that pain was significantly more intense in bruxers than among myofascial pain patients. Since in the Dao[5] study, bruxers did present with disturbed sleep (36.8%), self-reports of feeling tense (42.1%), and depression (10.5%), it seems clear that bruxers and TMD patients are more likely to use medication to reduce their stress, tension, and pain. TMD and bruxing behavior patients may also present more psychological and/or psychiatric disorders which make diagnosis and treatment more difficult. Shimshak and DeFuria[40] assessed health care utilization by patients with TMD compared to patients with health problems not related to the TMJs. They found that psychiatric claims in which TMD patients exhibited differences were at least twice as large as those of the non-TMD group. It is also likely that psychological disorders in bruxers make them more vulnerable to presenting musculoskeletal disorders. Supporting this idea, one study[41] attempted to predict responses to treatment for TMD. Results suggested that pretreatment distress and over concern about somatic functioning were indicative of poor response to treatment.

Murray, et al.[19] assessed a group of patients referred to a facial pain research unit and found that patients with the most symptoms, the most frequent pain, and pain episodes of the longest duration had the highest numerical pain ratings. These findings suggest that such patients are more likely to use more medications including pain killers, muscle relaxants and antidepressants. Bush and Harkins[42] and Dao, et al.[5] assessed pain related disability and quality of life and demonstrated significant impact of pain on daily living, the magnitude of which varied among diagnostic subgroups of TMD patients. Even though most bruxers do present capsulitis, moderate and severe bruxers are more likely to present other internal joint derangements including retrodiskal and disk-attachment pain.[14] These conditions increase the nociceptive input to the trigeminal system and the likelihood of using more drugs to alleviate pain and inflammation in these subgroups of TMD and bruxing behavior patients. In this respect, we agree with Greene, et al.[22] who suggests that there is greater prevalence of mild, moderate, and extreme pain levels in the TMD patient. Severe bruxers in this study made greater use of analgesics, anti-inflammatory drugs, and muscle relaxants because of the higher prevalence of specific joint and muscle disorders including MPDS and cervical pain. Such bruxers are more impaired by their pain and other functional disorders including decreased mouth opening, intermittent locking, and masticatory pain. The disability imposed by their pain, stress, anxiety, psychological tension, and sometime depression are common elements that increase with the severity and chronicity of pain. The destructive group in Ware and Rugh[13] was the one more impaired by pain and other functional jaw disorders and the one to make greater use of medication and splints. This group was similar to our group of severe bruxers.

Eleven patients (12.50%) in the mild group, 22 patients (22.0%) in the moderate group and 51 patients (27.27%) in the severe group had used occlusal splints (**Table 5**). It is apparent from our data that the use of these devices increased with the severity of bruxing behavior. Moderate and severe bruxers may be characterized as presenting a higher prevalence of specific joint and muscle disorders, and many of them could also be considered "treatment failures." Overall, 84 TMD and bruxing behavior patients (30.54 %) had used splints before their first visit for examination and diagnosis, and most of these patients were in the moderate and severe groups. Wessberg, et al.[43] observed that ten out of eleven patients treated with temporary occlusal splints obtained favorable results, but additional modes of therapy including prosthodontics were used, suggesting that splints were not so effective. It is important to remember, however, that the role of splints in TMD therapy is widely accepted, especially to control symptoms and protect the masticatory apparatus. Supporting our assumption, one study[44] demonstrated that signs of nocturnal bruxism were evident on the splint at any single appointment for monitoring signs and symptoms and occlusal wear on the splint in 61% of the cases and, from time to time, in 39% of the patients, thus suggesting that different degrees of nocturnal bruxism occurred on the splint which confirms previous findings that there are different groups of bruxers. Splints are accepted as reversible and noninvasive modes of therapy and their beneficial effects may occur on many anatomic masticatory structures. One study[45] suggests that the clinical improvement gained using these devices may be due, at least in part, to placebo effects and/or other psychosocial mechanisms. Sjoholm, Pollo and Alihanka[46] found that 50% of a group of TMD and bruxing behavior patients had used splints before being referred for diagnosis and treatment. Yatani[47] demonstrated that 32 of 260 patients did not improve to an acceptable level and were therefore in need of additional treatment.

One study[43] that assessed the effectiveness of three different modes of therapy for a group of bruxers found that nocturnal biofeedback and splint therapy decreased bruxing behavior, but when both modes of therapy were withdrawn, the bruxing behavior returned to baseline levels. Another study[45] evaluated the effectiveness of oral splints in the treatment of chronic MPDS patients. Patients used a full arch maxillary occlusal splint day and night except at meal times. Other modes of therapy were not used, and the period of therapy and monitoring was about eight weeks. Researchers observed a general reduction in pain and an improvement in the quality of life and suggested that when treating musculoskeletal pain of an unknown etiology like MPDS, it is sometimes necessary for the clinician and patient to accept that quality of life can improve but that a cure is not likely to occur. They concluded that stabilization splints remain an interesting conservative alternative to irreversible treatments or to long-term pharmacotherapy until a specific therapy for MPDS is developed. Another study[49] compared the effectiveness of nocturnal splint therapy versus 24-hour use in a group of 64 TMD patients presenting with myogenous pain. The treatment period was about two months. They found that continuous use of a splint had a better success rate (less than 25% variation) in alleviating headaches, facial pain, and limitation of opening. Researchers suggest that different types of dysfunction of the masticatory system do require different durations of splint use and probably different and/or a combination of devices.

The group of 275 TMD and bruxers in this study used an average number of different modes of therapy for pain, bruxism, and other chief complaints (about 1.36) (**Table 5**) which is similar to the average number of 1.9 modes of therapy observed by Fricton and Olsen.[32] The difference may be attributed to the increased chronicity and probably to the more difficult cases attributed to the patients in that study. Since there is evidence that the characteristics of pain, severity, persistency, and recent onset are strong predictors of the likelihood of health care consultation for pain management,[23] based on the data in the current study, it is plausible to suggest that severe bruxers in this study were subjected to more severe and chronic pain conditions compared to mild and moderate ones. Supporting our assumption, one study[5] demonstrated that pain may be significantly more intense in sleep bruxers who report pain than among MPDS patients.

Table 6 demonstrates that mild bruxers used a total of 76 analgesics and anti-inflammatory drugs (mean 0.7), moderate bruxers 169 (mean 2.01), and severe bruxers 191 (mean 2.18) compared to 28 in the TMD-nonbruxing group (mean 0.43). Mild bruxers used eleven muscle relaxant drugs (mean 0.10), moderate bruxers 8 (mean 0.09), and severe bruxers 17 (mean 0.20). Mild bruxers had used eleven splints (mean 0.10), moderate bruxers 22 (mean 0.26), and severe bruxers 51 (mean 0.61) before their initial consultation for examination and diagnosis. Because patients in the group of TMD and bruxing behavior had many consultations, had used a number of modes of therapy, and many of them were chronic pain patients, they could be considered "treatment failures." There is evidence that some health variables that differentiate the dysfunctional from the nondysfunctional patients appear to be consequences of the pain experience.[50] As the pain becomes more chronic, more stress, anxiety, and depression can be observed; therefore, there is increased need for drugs to reduce pain and anxiety and to improve sleep. Increased drug utilization has been reported as characteristic of facial pain patients.[51] These drugs may also have a disruptive effect on sleep patterns.[34] If the data is examined from another perspective, it is observed that mild bruxers had used 101 analgesics, muscle relaxants, and splints (mean 0.93), moderate bruxers about 206 (mean 2.45), and severe bruxers 267 (mean 3.21). Consequently, as bruxing behavior became increasingly severe, bruxers used more modes of therapy to attenuate their suffering and to improve their functional disorders. A study[50] found that TMD patients are unusually distressed individuals beleaguered by recent physical illnesses and injuries as well as pain, tend to attribute their fate to external factors, and have fewer of some important types of social support.

Conclusions

Current information suggests that there are different groups of TMD and bruxing behavior patients. This study is only one step toward determining the profile of different groups of bruxers based on previous consultations and modes of therapy including splints. Compared to mild bruxers and TMD-nonbruxer patients, moderate and severe bruxers are more impaired by their pain and other functional jaw and muscle disorders, and therefore make increased use of drugs and interocclusal devices, and seek more medical assistance for diagnosis and treatment. Because most TMD patients present at initial consultation with complaints of pain in some anatomic structures of the masticatory system and cervical structures and use of increased analgesics, anti-inflammatories, muscle relaxants, and splints, it is apparent that pain is the main reason patients are seeking medical and dental assistance. Before initial consultation, patients have used many modalities of treatment which they considered unsatisfactory. Some factors including intrinsic characteristics of pain, insufficient modes of therapy, severity of bruxing behavior, personality traits, and psychosocial factors may have contributed to these unsatisfactory clinical results.

Future studies should attempt to delineate more clearly the reasons why patients become chronic, and why the previously mentioned modalities of treatment were insufficient for their chief complaints. Based on this study, we hope to better identify these factors and to enhance modalities of therapy. The most significant finding in this study was the identification of three groups of bruxers and the observations made as to their increased use of medications and interocclusal devices increasing with the severity of bruxism. Future studies should attempt to develop more effective modes of therapy for patients presenting with TMD and moderate and severe bruxing behavior. Since bruxing behavior is thought to be a significant etiological factor for TMD, headache, and cervical pain, and groups of TMD patients present with a high prevalence of bruxing behavior, the treatment of TMD should include an assessment of the severity of bruxing behavior and its management in order to decrease loading and persistent tension on the masticatory muscles and the temporomandibular joints.

Acknowledgement

We would like to thank John Schoolfield, statistician in the statistical/mathematical support group at the University of Texas, Health Science Center at San Antonio for his valuable statistical analysis for this project.

References

1. Treacy K: Awareness/relaxation training and transcutaneal electrical stimulation in the treatment of bruxism. *J Oral Rehab* 1999; 26:280-287.
2. Trenouth MJ: The relationship between bruxism and temporomandibular dysfunction as shown by computer analysis of nocturnal tooth contact patterns. *J Oral Rehab* 1979; 6:81-87.
3. Leof M: Clamping and grinding habits: their relation to periodontal disease. *JADA* 1944; 31:184-194.
4. Almansi RJ: Psychosomaticsin dentistry. *J Dent Med* 1949; 4:98-101.
5. Dao TT, Lund JP, Lavigne GJ: Comparison of pain and quality of life in bruxers and patients with myofascial pain of the masticatory muscles. *J Orofac Pain* 1994; 8:350-356.
6. Olkinuora M: A psychosomatic study of bruxism with emphasis on mental strain and familial predisposing factors. *Proc Finn Dent Soc* 1972; 68:110-123.
7. Scholte AM, Steenks MH, Bosman F: Characteristics and treatment outcome of diagnostic subgroups of CMD patients. *Comm Dent Oral Epidemiol* 1993; 21:215-220.
8. Rudy TE, Turk DC: Integrating behavioral and dental treatments: utility of customizing protocols. In: *Progress in pain research and management* Seattle:IASP Press 1995; Vol.4.
9. Kampe T, Tagdae T, Tagdae G,Edman G,Karlsson S: Reported symptoms and clinical findings in a group of subjects with long-standing bruxism. *J Oral Rehab* 1997; 15:314-325.
10. Johansson A, Haraldson T, Omar R, Kiliaridis S, Carlsson GE: A system for assessing the severity and progression of occlusal wear. *J Oral Rehab* 1993; 20:125-131.
11. Molina OF, dos Santos J, Nelson S, Grossman E: Prevalence of modalities of headache and bruxism among patients with craniomandibular disorders. *J Craniomandib Pract* 1997; 15:314-325.
12. Clarke NG, Townsend GC, Carey SE: Bruxism patterns in man during sleep. *J Oral Rehab* 1984; 11:123-127.
13. Ware JC, Rugh JD: Destructive bruxism: sleep stage relationships. *Sleep* 1988; 2:172-181.
14. Molina OF, dos Santos J, Nelson S, Nowlin T: A clinical study of specific signs and symptoms of CMD in bruxers classified by the degree of severity. *J Craniomandib Pract* 1999; 17:268-279.
15. Lobbezoo AM, Lobbezoo F, Steenks MH, De Leeuw JR, Bosman F: Diagnostic subgroups of craniomandibular disorders Part II: Symptom profile. *J Orofac Pain* 1995; 9:37-43.
16. Lobbezoo AM, De Leeuw JR, Steenks MH, Bosman F, Buchner R, Olthoff LW: Diagnostic subgroups of craniomandibular disorders Part I: Report data and clinical findings. *J Orofac Pain* 1995; 9:24-36.
17. Okeson JP, Kemper JT, Moody PM: A study of the use of occlusion splints in the treatment of acute and chronic patients with craniomandibular disorders. *J Prost Dent* 1982; 48:708-712.
18. Mejersjo C, Carlsson GE: Long-term results of treatment for temporomandibular joint pain dysfunction. *J Prost Dent* 1983; 49:809-815.
19. Murray L, Locker D, Mock D, Tenenbaum HC: Pain and the quality of life in patients referred to a craniofacial unit. *J Orofac Pain* 1996; 10:316-323.
20. Fricton JR, Hathaway KM, Bromaghim C:Interdisciplinary management of patients with TMJ and craniofacial pain: characteristics and outcome. *J Craniomandib Disord Facial Oral Pain* 1987; 1:115-122.
21. Ren YF, Isberg A: Tinnitus in patients with temporomandibular joint internal derangements. *J Craniomandib Pract* 1995; 13:75-80.
22. Greene CH, Lerman MD, Sutcher HD, Laskin DM: The temporomandibular joint-pain dysfunction syndrome: heterogeneity of the patient population. *JADA* 1969; 79:1168-1172.
23. Agerberg G, Helkimo M: Symptomatology of patients referred for mandibular dysfunction: evaluation with the aid of a questionnaire. *J Craniomandib Pract* 1987; 5:158-163.
24. Clark GT, Beemsterboer RL, Rugh JD: Nocturnal masseter muscle activity and the symptoms of mandibular dysfunction. *J Oral Rehab* 1981; 8:279-281.
25. Schellas KP: Internal derangements of the temporomandibularjoint: radiologic staging with clinical, surgical and pathological correlations. *Mag Res Imaging* 1989; 7:495-515.
26. Morawa AP, Loos PJ, Easton JW: Temporomandibular joint dysfunction in children and adolescents: incidence, diagnosis and treatment. *Quint Internat* 1985; 11:771-777.
27. Von Korff M, Dworkin SF, LeResche L, Kruger A: An epidemiological comparison of pain complaints. *Pain* 1988; 32:173-183.
28. Von Korff M, Wagner E, Dworkin SF, Saunders KW: Chronic pain and use of ambulatory health care. *Psychosom Med* 1991; 53:61-79.
29. Luz JG, Maragno IC, Martin MC: Characteristics of the chief complaint of patients with temporomandibular disorders in a Brazilian population. *J Orofac Pain* 1997; 24:240-243.
30. Yustin D, Neff P, Rieger MR, Hust T: Characteristics of 86 bruxing patients and long term study of their management with occlusal devices and other forms of therapy. *J Orofac Pain* 1993; 7:54-60.
31. Butterworth JC, Deardorff WW: Psychometric profiles of craniomandibular pain patients: Identifying specific subgroups. *J Craniomandib Pract* 1987; 5:226-232.
32. Fricton JR, Olsen T: Predictors of outcome for treatment of temporomandibular disorders. *J Orofac Pain* 1996; 10:54-65.
33. Sternbach RA, Janowsky DS, Leighton HY, Segal DS: Effects of altering brain serotonin activity in human chronic pain. In: Bonica JJ, Abe-Fessard D, eds. *Advances in pain research and therapy*. Vol 1 New York: Raven Press, 1976:601-603.
34. Kreisberg MK: Tricyclic antidepressants: analgesic effect and indications in orofacial pain. *J Craniomandib Disord Facial Oral Pain* 1988; 2:171-177.
35. Graff-Radford SB, Reeves JL, Jaeger B: Management of chronic head and neck pain: effectiveness of altering factors perpetuating myofascial pain. *Headache* 1987; 27:186-190.
36. Kampe T, Edman G, Bader G, Tagdae T, Karlsson S: Personality traits in a group of subjects with long-standing bruxing behavior. *J Oral Rehab* 1997; 24:588-593.
37. Reik L, Hale L: Health care utilization by older adults in response to painful orofacial symptoms. *Pain* 1999; 81:67-75.
38. Fricton JR, Kroening R: Practical differential diagnosis of chronic orofacial pain. *Oral Surg* 1982; 54:628-634.
39. Clark GT, Rugh JD, Handelman SL, Beemsterboer PL: Stress perception and nocturnal masseter muscle activity. *J Dent Res* [Special Issue] 1977; 56; B-161.
40. Shimshak DG, DeFuria MC: Health care utilization by patients with temporomandibular joint disorders. *J Craniomandib Pract* 1998; 16:185-193.
41. McCreary CP, Clark GT, Oakley ME, Flack V: Predicting response to treatment for temporomandibular disorders. *J Craniomandib Disord Facial Oral Pain* 1992; 6:161-170.
42. Bush FM, Harkins SW: Pain-related limitations in daily living in patients with chronic orofacial pain: psychometric properties of a disability index. *J Orofac Pain* 1995; 9:57-63.
43. Wessberg GA, Carroll WC, Dinham R, Wolford L: Transcutaneal electrical nerve stimulation in the management of myofascial pain-dysfunction syndrome. *J Prosthet Dent* 1981; 45:306-313.
44. Holmgren K, Sheikholeslam A, Riise C: Effect of a full-arch maxillary occlusal splint on parafunctional activity during sleep in patients with nocturnal bruxism and signs and symptoms of craniomandibular disorders. *J Prosthet Dent* 1993; 69:293-297.
45. Dao TT, Lavigne GJ, Charbonneau A, Feine J, Lund J: The efficacy of oral splints in the treatment of myofascial pain of the jaw muscles: a controlled clinical trial. *Pain* 1994; 56:85-94.
46. Sjoholm T, Pollo OJ, Alhanka JM: Sleep movements in teeth grinders. *J Craniomandib Disord Facial Oral Pain* 1992; 6:184-191.
47. Yatani H, Minakuchi H, Matuka Y, Fujisawa T: The long-term effects of occlusal therapy on self-administered outcome of TMD. *J Orofac Pain* 1998; 12:75-88.
48. Pierce CJ, Gale EN: A comparison of different treatments for nocturnal bruxism. *J Dent Res* 1988; 67:597-601.
49. Wilkinson T, Hansson TL, McNeill C, Marcel T: A comparison of the success rate of 24-hour occlusal splint therapy versus nocturnal occlusal therapy in reducing craniomandibular disorders. *J Craniomandib Disord Facial Oral Pain* 1992; 6:64-70.
50. Marbach JJ, Lennon MC, Dohrenwend DP: Candidate risk factors for temporomandibular pain and dysfunction syndrome: psychosocial, health behaviors, physical illness and injury. *Pain* 1988; 34:139-151.
51. Swanson DW, Maruta T, Wolff VA: *Ancient pain* 1986; 25:383-387.

Dr. Jose dos Santos, Jr. *received a D.D.S. degree in 1959 from the University of Sao Paulo Dental School, Brazil. He is a former Associate Professor at the same school and received a Masters Degree in restorative dentistry from Rackham Institute of Graduate Studies, University of Michigan. He is a former Associate Professor at the Department of Occlusion and Orofacial Pain/Temporomandibular Joint Clinic at the University of Michigan, School of Dentistry. Currently, Dr. dos Santos is a Professor at the University of Texas Health Science Center, San Antonio, Texas. He is also Director of Programs for Continuing Education for Brazilian dentists in the U.S. and has published several books.*

Dr. Stanley J. Nelson *is currently an Associate Professor in the Division of Occlusion, Department of Restorative Dentistry, University of Texas Health Science Center at San Antonio, Texas. He received a D.D.S. degree in 1979 and a M.S. degree in Restorative/Occlusion in 1986 from the University of Michigan School of Dentistry, where he also served as faculty in the school's Department of Occlusion. Dr. Nelson has published numerous scientific articles and is currently serving on the Board of Directors of the American Equilibration Society.*

Dr. Thomas P. Nowlin *is a Professor and Head of the Division of Occlusion, Department of Restorative Dentistry at the University of Texas Health Science Center at San Antonio Dental School. He has been active in teaching and research into occlusion and temporomandibular joint disorders for 20 years and now directs the TM Disorders course of study. Dr. Nowlin is past chairman of the American Association of Dental Schools Section on Dental Anatomy and Occlusion and also continues to treat TM disorder patients in the university clinic.*